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# Research Briefs

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## Nutrition and Health

The reason why so many dieters lose the first few pounds quickly, then can't lose the rest, is because their caloric intake isn't decreasing along with their weight. That is the first finding from two weight-loss studies of volunteers in the Beltsville room calorimeter. Study results don't support the currently popular premise that people's metabolism slows down in response to fewer calories. ARS scientists assessed the number of calories 28 overweight men burned before, during and after they cut their caloric intake by 25 or 50 percent. While dieting, the men burned fewer calories, but no less than would be expected from reducing the amount of food they had to digest, absorb, convert and store from daily meals. And most of the drop occurred on the first day of the weight-loss diets—too soon to be attributed to an energy-saving loss in metabolic rate.

*Beltsville Human Nutrition Research Center  
Beltsville, MD*

William V. Rumpler, (301) 344-4360

The popular sunscreen PABA is helping scientists who are studying diet and weight problems monitor the caloric consumption of research volunteers. Experience has shown that volunteers in diet studies often have difficulty overeating day after day. But, since every morsel must be eaten

and every drop of urine collected so as to account for every calorie, scientists were looking for a way to monitor a group of men who would be required to eat an extra 1,000 calories a day—one-third their normal consumption. PABA, once thought to be part of the B vitamin complex, is harmless when eaten. When added to food, the scientists found that 99 percent of its components will appear in the urine within 8 hours. If less than 93 percent of its components are recovered, it means a volunteer cheated by not eating all his food or collecting all his urine. So far, the PABA test has disqualified 3 of 26 volunteers in one study. The use of PABA could have wider applications in other nutrition studies, particularly in monitoring the food intake of anorexic or bulimic patients.

*Human Nutrition Research Center on Aging at Tufts  
Boston, MA*  
Susan Roberts/Frank D. Morrow, (617) 556-3227/3166

Researchers have found a clue as to why mice and rats retain a stronger immune system when their food intake is dramatically restricted throughout life. Knowing how food restriction works means scientists can look for practical alternatives to improve older people's ability to fight infection and nip would-be cancers in the bud. Allowing mice to eat only 80 percent of their normal caloric intake after weaning significantly reduced their synthesis of prostaglandin E<sub>2</sub> (PGE<sub>2</sub>). This hormone-like compound is known to suppress function of the immune system, so suppressing it helps to boost immunity. Other less stringent dietary modifications, such as increasing vitamin E intake, can also reduce PGE<sub>2</sub> levels. Researchers expect that food restriction causes other changes in body chemistry besides a drop in this compound. But the finding is a beginning.

*Human Nutrition Research Center on Aging at Tufts  
Boston, MA*  
Simin Nikbin Meydani, (617) 556-3129

An organic acid that occurs naturally in strawberries and apples may reduce the risk of some forms of cancer. In animal and human tissue, medical researchers found that ellagic acid in purified form reduced the incidence of cancer caused by some carcinogenic chemicals. ARS scientists are testing different strawberry and apple varieties to study the genetics associated with the production

of ellagic acid in fruit. They're hoping to breed varieties high in the acid—but have not yet determined how much would be needed in diets to be effective against cancer.

*Fruit Lab, Beltsville, MD*

*John L. Maas, (301) 344-3572*

**Vitamin D's Recommended Dietary Allowance** may be too low to protect older women from losing bone calcium during late winter, when reserves are lowest. Without direct sunlight, the skin makes little or no vitamin D, which helps the body to absorb calcium. And when not enough of the vitamin is supplied by food or supplements, the body may "borrow" calcium from the bones to maintain a constant blood level. In a study of 333 women past menopause, those who consumed at least 10 percent more vitamin D than the RDA of 200 international units did not have the seasonal see-saw of hormones that regulate blood calcium levels. The women's vitamin D levels hit their lowest in late winter and early spring. At the same time, levels of the hormone thought to pull calcium from the bones were at their highest. The women averaged 58 years of age and were all healthy Caucasians—the group most prone to develop osteoporosis. The findings hint that older people and those with absorption difficulties or diseases that affect vitamin and mineral levels would need even more vitamin D. But further studies are needed before a specific level can be recommended.

*Human Nutrition Research Center on Aging at Tufts  
Boston, MA*

*Elizabeth Krall, (617) 556-3069*

**"Tired blood" sufferers take note:** Adding a serving of vitamin C-rich foods to each meal can help you absorb more iron from plant foods. Many women have difficulty getting enough iron in their diets, despite a recently lowered RDA for the mineral. And cutting back on red meat consumption increases their problem. A recent study of 11 borderline anemic women showed that adding vitamin C to each meal significantly improved their absorption of iron from breads, cereals and other plant sources throughout 5-1/2 weeks of supplementation. The supplemented group showed significant improvement in several indicators of iron status compared with those who got a placebo instead. Scientists note it's preferable to add vitamin C through foods. Tomatoes, cantaloupe, broccoli, potatoes and the cabbage family are nearly as rich in the vitamin as citrus.

*Grand Forks Human Nutrition Research Center*

*Grand Forks, ND*

*Janet R. Hunt, (701) 795-8323*

**While a glass of milk a day** can go a long way toward preventing osteoporosis, preliminary findings indicate that, in certain people, it may increase the risk of developing cataracts. Infants who have a rare genetic disorder

that prevents them from metabolizing a component of milk sugar develop cataracts early in life if fed milk. These infants are lacking enzymes necessary to metabolize the sugar galactose. Now, an epidemiological study of 112 people between 40 and 70 years old suggests that enzyme level can influence a person's risk of developing cataracts later in life. Those whose levels of galactokinase were at the low end of the normal range had four times as many cataracts as those having average levels and above, even if they had consumed as little as one cup (8 oz.) of milk a day. But those in the low-enzyme group who had not consumed milk or other sources of galactose, such as yogurt, cheese or ice cream, had about the same cataract incidence as the group with higher levels. No one should stop drinking milk, however, until the findings are confirmed in other studies.

*Human Nutrition Research Center on Aging at Tufts  
Boston, MA*

*Paul F. Jacques, (617) 556-3322*

**Selenium now has a Recommended Dietary Allowance** thanks to an ARS expert on the mineral and his association with Chinese scientists, whose work is the basis for the new recommendation. ARS research chemist Orville Levander wrote the report supporting the RDA for selenium; 70 micrograms for men and 55 for women should more than maintain adequate body levels of this antioxidant in most Americans. We get ample selenium through our diets even in areas where soil selenium levels are low because of our nationwide food distribution system. So there is no need for supplements. And megadoses--10 times the RDA and up--can be dangerous.

According to Chinese studies, the difference between the new RDA and toxic levels is only about 11-fold.

*Beltsville Human Nutrition Research Center*

*Beltsville, MD*

*Orville Levander, (301) 344-2504*

**Manufacturers of fish oil capsules** add extra vitamin E to prevent this highly unstable oil from going rancid on the shelf. But is it enough to prevent the oil from oxidizing in the body? Apparently not, according to a study of 25 women who took 6 capsules a day for 3 months. Levels of lipid peroxides—the damaging byproducts of oxidation—increased 30 percent in the women who were in their mid-20's and 50 percent in women in their early 60's, even though their vitamin E levels were significantly higher. This could spell trouble since these peroxides can damage cellular structures, including DNA. The fish oil capsules contained 1 milligram (mg) of vitamin E per gram of oil. According to earlier analyses, the amount of vitamin E in 13 brands of fish oil capsules on the market today ranges from 0.6 mg to 2.2 mg. It now appears

## **Comments on the Oat Bran Question**

Don't pitch the oat bran products, if they're also low in fat. At the very least, these products can help lower cholesterol by replacing fat in the diet, as do other complex carbohydrates—fruits, vegetables and cereal grains. Findings of the recently reported study comparing oat bran with wheat flour support the concept that the amount of fat we eat is the strongest determinant of cholesterol levels in those of us who didn't inherit high cholesterol. The more fat we eat the more cholesterol the liver needs to transport that fat in the form of HDL, LDL and other lipoproteins. So a drop in dietary fat translates to a lower requirement for cholesterol.

It isn't surprising that oat bran failed to reduce cholesterol further in subjects whose levels were already in the desirable range. Normally, when cholesterol levels climb too high, the liver knows enough to stop producing it and dispose of the excess by converting it into bile acids. The acids are dumped into the intestinal tract and either carried out with the stool or reabsorbed, making them available to be converted back to cholesterol. It is thought that soluble fiber reduces cholesterol because it is particularly good at removing bile

acids from the intestinal tract rather than leaving them behind to be recycled. But when cholesterol levels are in a desirable range—and scientists don't know what the body considers a desirable range—the liver probably maintains the status quo.

Judging from other research, there's no reason to think that oat bran's soluble fiber—and oats contain more than most grains—isn't as effective at reducing elevated cholesterol as the pectins and gums in fruits and vegetables. It should be noted that, except for a few studies, high-fiber foods rather than purified fiber have produced the beneficial effects.

Even if soluble fiber had no effect on cholesterol, its greatest contribution to health is that it slows absorption of glucose from a meal, smoothing out blood sugar and insulin levels between meals. This helps control weight because it keeps us from getting hungry as fast. Over the long run, it helps prevent diabetes, which dramatically increases risk of heart disease. So you can't go wrong with a good helping of soluble fiber each day by eating a variety of fruits and vegetables and, yes, oat bran.

*Gerald F. Combs  
ARS Program Staff/Human Nutrition  
(301) 344-3216*

these levels may not be sufficient to protect users from cellular damage.

*Human Nutrition Research Center on Aging at Tufts  
Boston, MA  
Mohsen Meydani, (617) 556-3126*

**Older people who smoke**, in addition to being at greater risk for several diseases, are generally not as well nourished as those who don't. The finding is from a comparison of the nutritional status of 746 men and women between the ages of 62 and 100. The 87 who smoked had significantly lower blood levels of vitamin C, riboflavin, magnesium and vitamin A and related carotenoids than the 659 who didn't smoke. Their choice of less nutritious foods, not the amount of food consumed, accounted for most of the difference. Smokers ate about the same number of calories as nonsmokers of the same age and sex. For reasons unknown, blood calcium levels were higher in the smokers—even though they consumed less of the mineral.

*Human Nutrition Research Center on Aging at Tufts  
Boston, MA  
Sandra I. Sulsky, (617) 556-3323*

## **Food and Water Freshness and Safety**

**How firm do these apples sound?** Scientists are developing a way to rapidly measure the firmness and maturity of apples based on their absorption of low-frequency sound waves. Firmness and maturity are important considerations in regulations covering the shipping and marketing of fresh fruit. At present, the apple industry uses a relatively slow procedure that measures the pressure needed to penetrate sample apples to a specific depth. With the new method, each apple is exposed to either a physical thump or momentary "click" sound as it passes by a tiny speaker. Corresponding measurements of sound coming through the apple reveal how firm and mature it is. Once fully automated, this approach could be used to test around five apples per second, as compared to two apples per minute under the old method.

*Instrumentation and Sensing Lab, Beltsville, MD  
Judith A. Abbot/Henry A. Affeldt, (301) 344-3650*

Fresh fruits and vegetables that are less likely to spoil in shipping and storage may eventually result from a recent advance in genetic engineering. Much produce harvested in the United States is lost due to overripening, and ethylene (a ripening hormone formed naturally by the plants) is blamed for much of that waste. Now, scientists have isolated and cloned a gene which plants must have in order to make ACC synthase—an enzyme needed in one of the final steps leading to the plant's production of ethylene. Armed with this new knowledge, biotechnological researchers can zero in on stopping the ACC synthase enzyme and thus thwart ethylene formation—a goal that may take another 5 to 10 years to achieve.

*USDA-University of California Plant Gene Expression Center, Albany, CA  
Athanasios Theologis, (415) 559-5911*

Eight natural aroma chemicals are responsible for the rich, fruity flavor of high-quality tomato paste, scientists have now learned. They focused on aroma-imparting chemicals because how something smells often dictates how it will taste. One volatile, beta-damascenone, was so potent that aroma panelists could detect it at less than one part per 100 billion—the equivalent of a pinch of salt in 1,000 tons of potato chips. Critical chemicals were identified by a "sensory panel" of volunteers and studies using sophisticated lab tests and computers. Processors of tomato paste can use the new findings to check flavor quality and possibly enhance flavor by modifying factory procedures such as the methods of heating tomatoes. The research should also help genetic engineers and tomato breeders develop better tasting tomatoes for processing.

*Food Quality Research, Albany, CA  
Ronald G. Buttery, (415) 559-5667*

Agricultural chemicals have less chance of reaching groundwater when farmers use a computer model to help them decide whether and how to apply chemicals through irrigation sprinklers. Farmers can irrigate, fertilize and apply pesticides all at the same time in a technique called chemigation. It often allows farmers to split a chemical application over two or more irrigations. ARS has modified its groundwater computer model, called GLEAMS (Groundwater Loading Effects of Agricultural Management Systems), to evaluate the technique. Computerized simulations with ten major herbicides and one nematicide were reasonably close to actual field observations. A typical example: Chemigation reduced by about 40 percent the average annual amount of the nematicide fenamiphos that leached below the root zone. It also reduced by about a third the average annual amount of two toxic byproducts leached below the crop roots. With conventional spraying, farmers usually apply more chemical to be sure enough stays in the upper soil for the desired length of time. Splitting the applications in chemigation allows farmers to achieve the same goal

while reducing both individual and total doses.  
*Southeast Watershed Research Lab, Tifton, GA  
Ralph A. Leonard, (912) 386-3290*

Yellow corn mash can be used not only to fuel a car but also to help get rid of cockroaches. Corn mash from producing ethanol and a water-absorbent gel are key ingredients in a new toxic bait that attracts and kills at least 15 species of cockroaches. Invented by ARS scientists, the bait, called Insect Control System, also works against grasshoppers, crickets and fire ants. The corn mash and the gel keep the bait aromatic and moist under high temperatures and dry conditions when a cockroach's metabolism increases, making it hungry and thirsty. Cockroaches are especially turned on by a moist bait. A microencapsulated toxin inside the bait kills the insect. While corn mash lures these insects, it doesn't attract mammals. Even with dry food and water available, research shows that cockroaches find the new bait more appealing.  
*Insects Affecting Man and Animals Research Lab  
Gainesville, FL  
Richard J. Brenner, (904) 374-5937*

A worthless byproduct of sugar processing might turn out to be worth big bucks. This byproduct, known as levan, is a natural gum made by the soil microorganism *Bacillus polyxma* to protect the bacteria from harmful invasion. It also can be used by the bacteria as a food reservoir. ARS scientists are patenting a way to rapidly produce levan. It can be used in printing, cosmetics and sweetners, as a thickener and possibly to maintain the blood volume of a patient suffering severe loss of blood. Levan is found in certain plants, such as sugar beets, and in sugar-processing factories. Scientists found that growing *B. polyxma* on a sucrose solution produced three times as much levan and in a purer form than at least 28 other levan-producing microorganisms tested on the solution. ARS and Sugar Processing Research, Inc., in New Orleans, began working 2 years ago on ways to diversify the sugar industry to find other valuable products besides sugarcane. San Diego-based Kelco Co., a division of Merck Co., of Rahway, NJ, has a research and development agreement with ARS to commercialize the levan-production technique.

*Food and Feed Processing Research, New Orleans, LA  
Youn W. Han, (504) 286-4228*